

Armed Forces College of Medicine

AFCM

Muscle stretch

Muscle Stretch Reflex

Dr. Dalia Abd Elsalam Saad

INTENDED LEARNING OBJECTIVES (ILO)

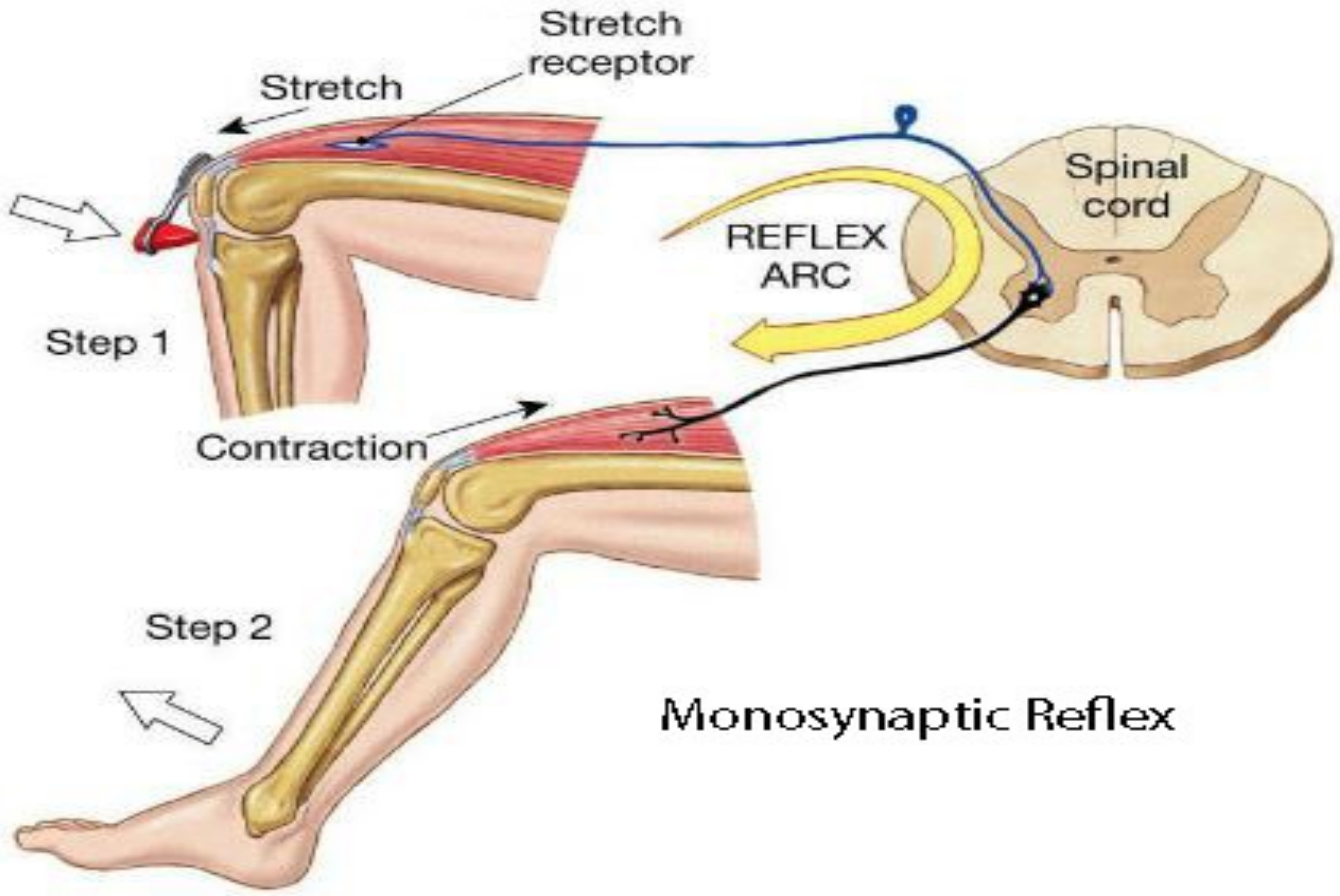
By the end of this lecture the student will

be able to:

1) Describe the functional structure of the muscle spindle
2) List the mechanism of stimulation of muscle spindle
3) Describe the stretch reflex (dynamic and static)
4) List the supra-spinal control of stretch reflex
5) Evaluate the role of alpha and gamma motor neuron in controlling the muscle tone and stretch reflex

Components of reflex arc & Monosynaptic reflex

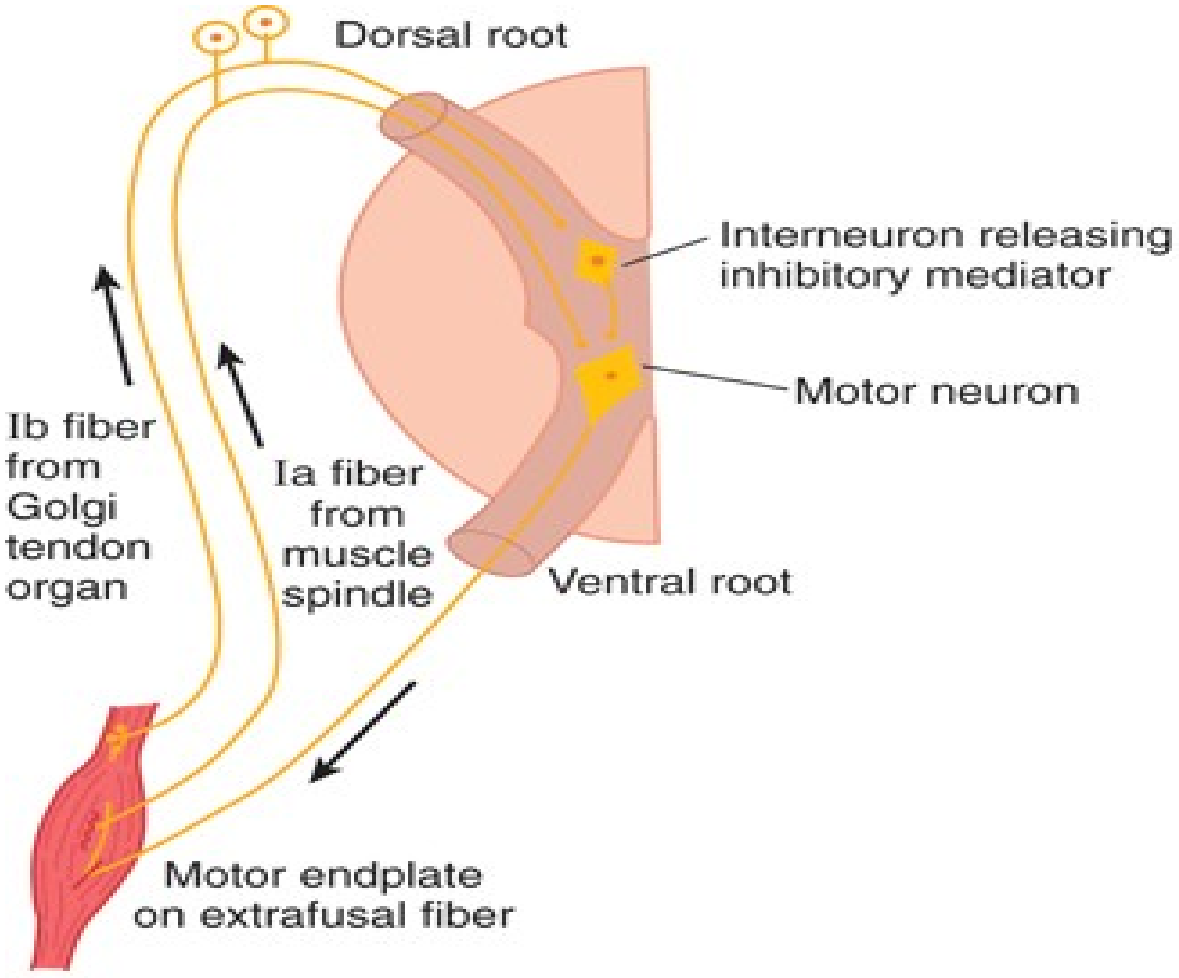
- Types of movements
- Components
- Types



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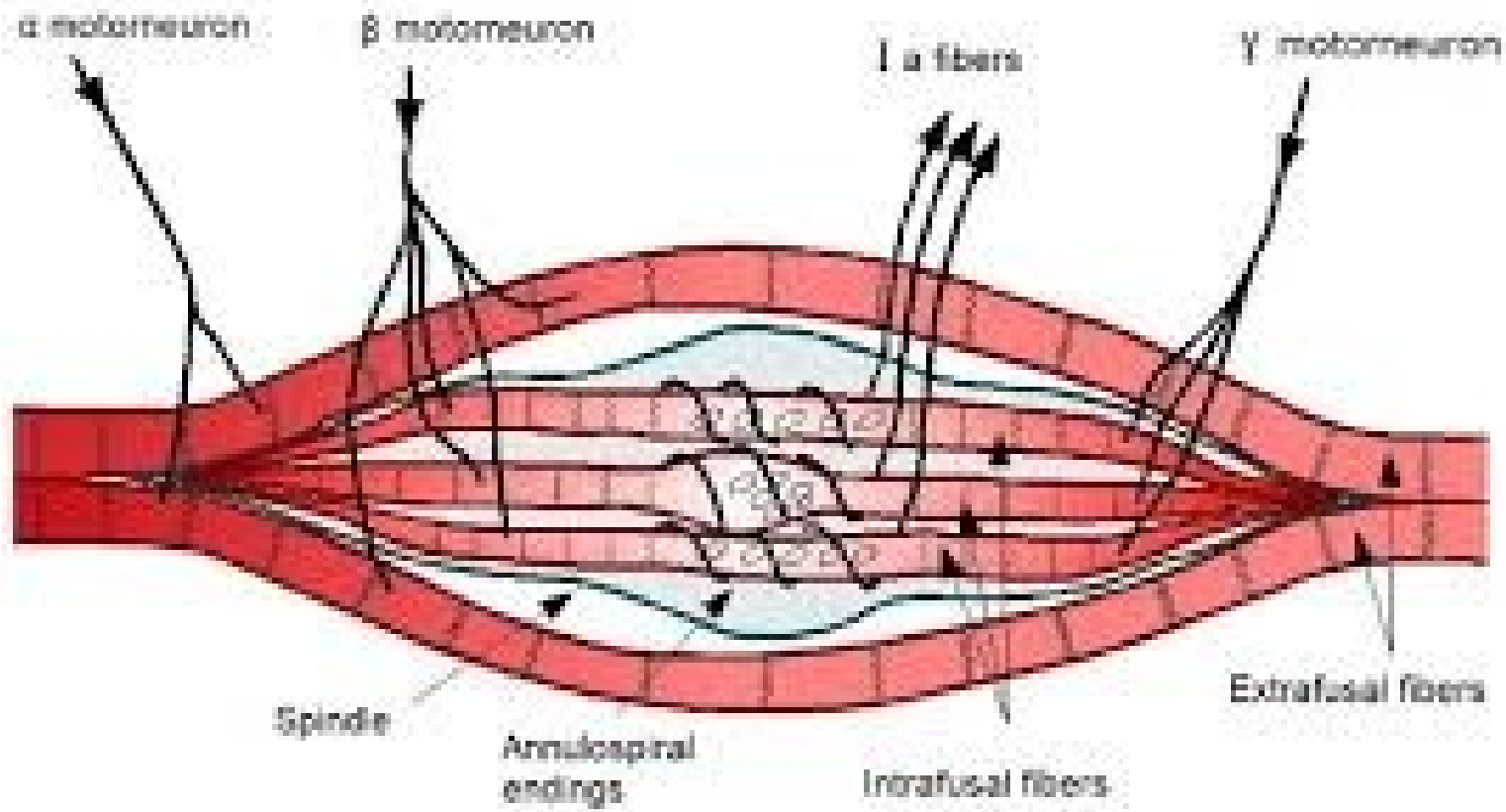
Muscle stretch reflex

- Definition
- Mono-synaptic reflex
- Function



Source: Barrett KE, Barman SM, Boitano S, Brooks H: *Ganong's Review of Medical Physiology, 23rd Edition*: http://www.accessmedicine.com

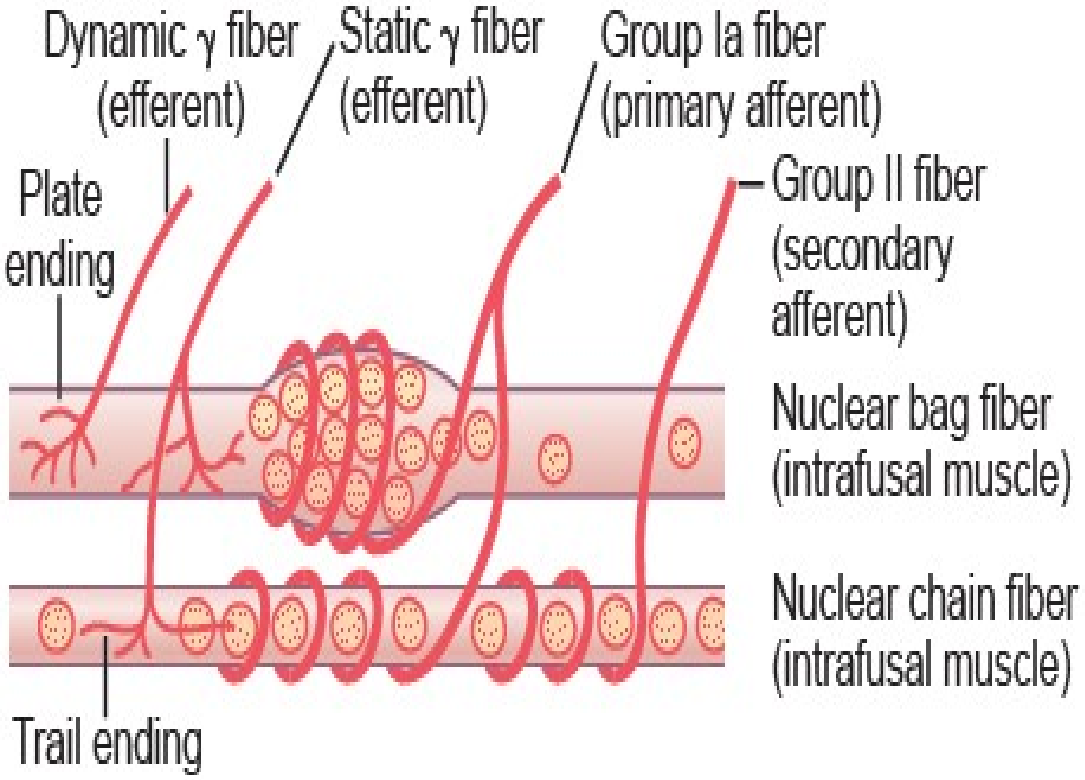
Muscle spindle



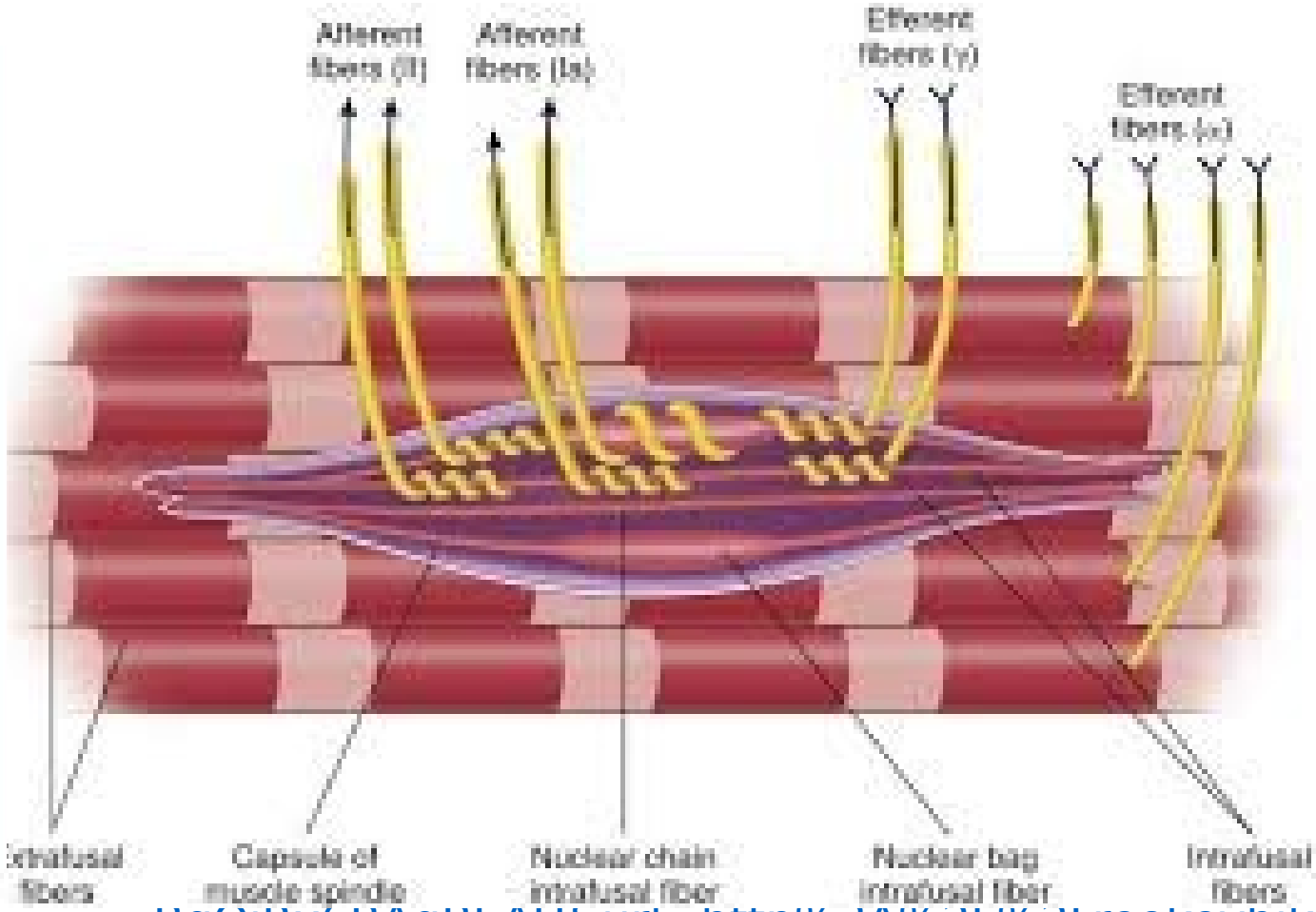
The muscle spindle

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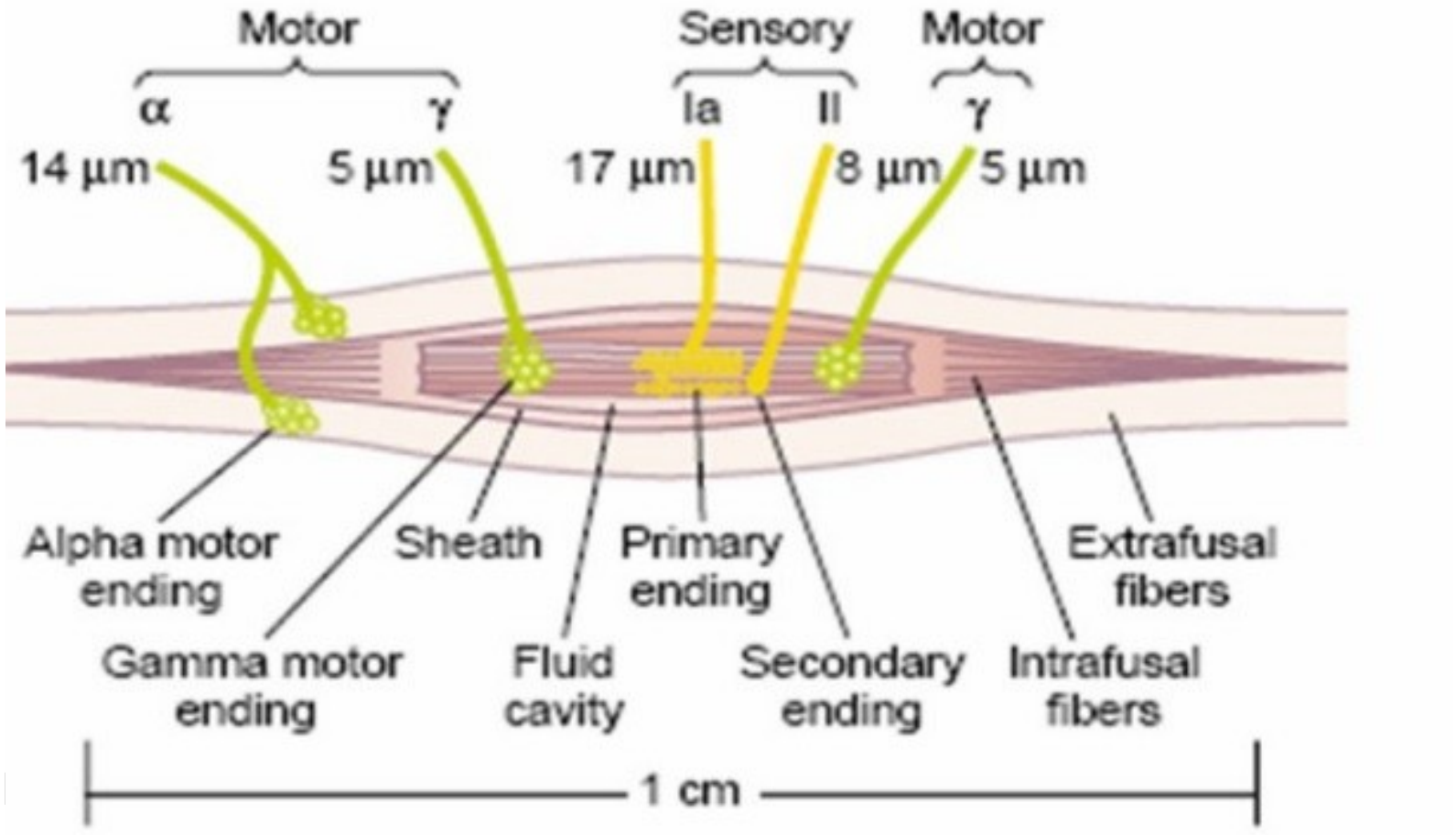
Innervation of muscle spindle



Ghyton and Hall 13th edition P697

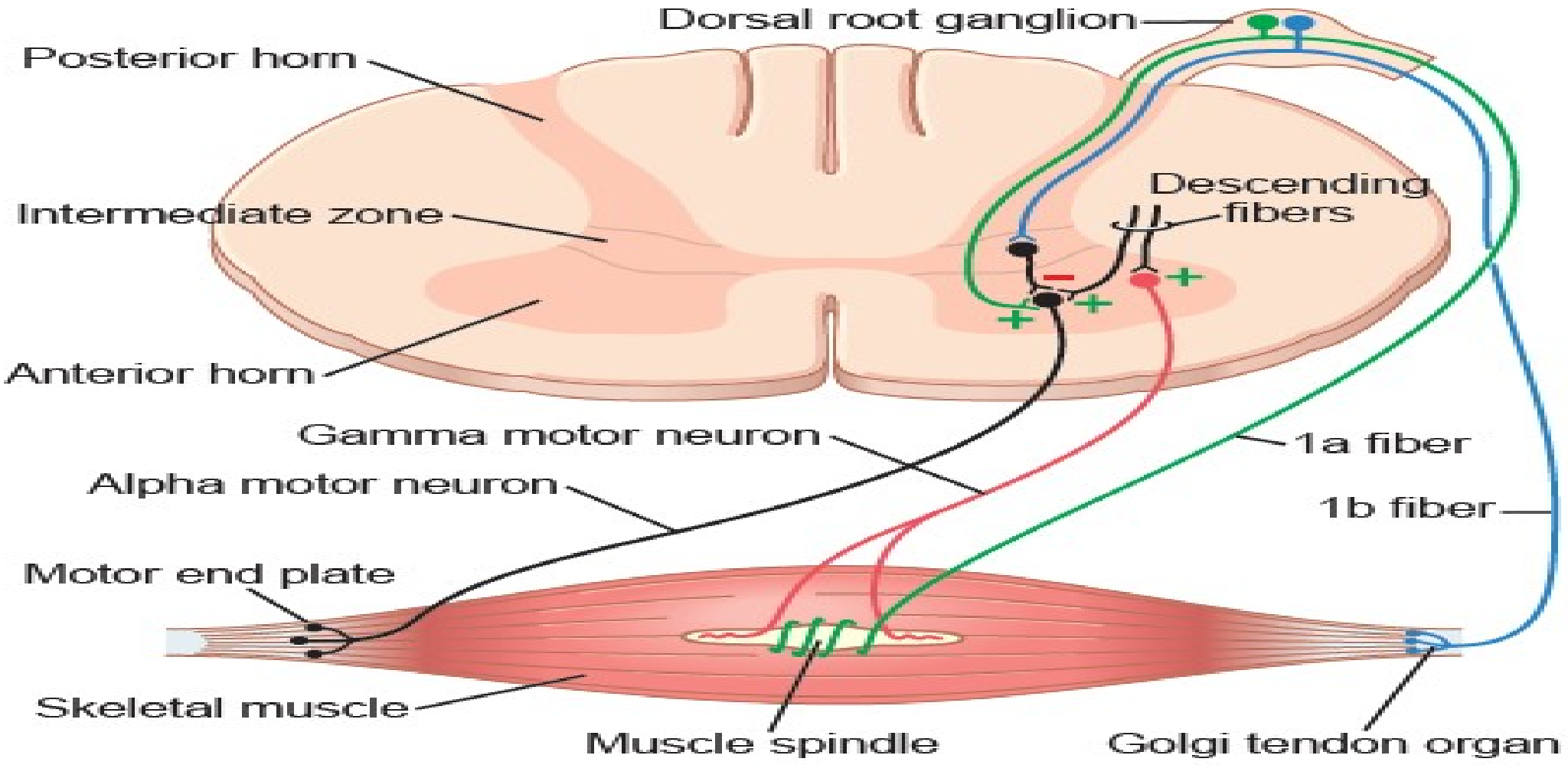


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Motor
Sensory
Motor
α
γ
Ia
II
γ
14 µm
5 µm
17 µm
8 µm
5 µm
Alpha motor ending
Sheath
Primary ending
Extrafusal fibers
Gamma motor ending
Fluid cavity
Secondary ending
Intrafusal fibers
1 cm

Ghyton and

Pathway of muscle stretch reflex



Ghyton and Hall 13th edition P 657

Difference between 1ry & 2ry nerve endings

	1ry	2ry
Site	Nuclear Bag & chain	Nuclear Chain
Thickness	Thick = rapid conduction	Less thick = slower
Adaptation	Phasic = rapidly adapting	Tonic= slowly adapting
Function	Dynamic = response on sudden short stretch	Static = response on continuous steady weak stretch

Gamma efferent functions

1. Reflex skeletal muscle contraction
2. Intensify the response = maximum response
3. Maintain the muscle spindle sensitivity
4. Site for higher control of stretch reflex

Supraspinal Regulation of MSR

- **Facilitatory centers:**

1. 1ry motor area(4)
2. Facilitatory (pontine) reticular formation = intrinsic activity, ventral RS
3. Neocerebellum
4. Vestibular nucleus = vestibulospinal
5. Caudate nucleus of basal ganglia

- **Inhibitory centers:**

1. Cortical suppressor area = 4s, 6s
2. Inhibitory reticular formation (medullary) = lateral RS
3. Paleo cerebellum
4. Red nucleus = rubrospinal
5. Lentiform nucleus of basal ganglia

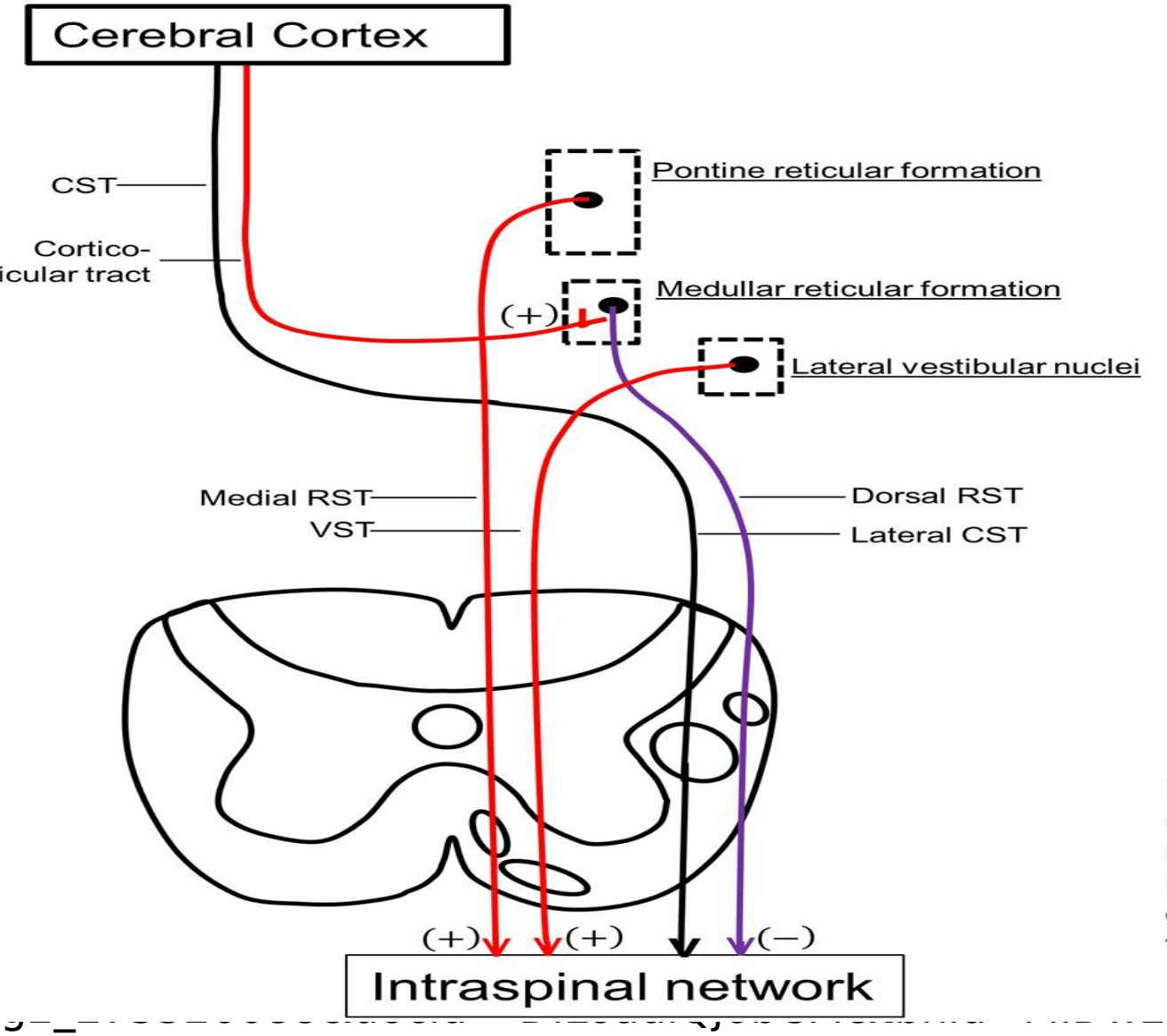


Illustration of supraspinal control of spinal stretch reflex. CST: cortical spinal tract; RST: reticulospinal tract; VST: vestibular spinal tract; (+): facilitation; (-): inhibition. NOTE: other descending pathways, such as rubrospinal tract, tectospinal tract, medial CST are not shown here.

Lecture Quiz

Draw a diagram of muscle stretch reflex?

Which one of the following is the correct sequence for a regulatory reflex arc?

a) Stimulus, effector, efferent pathway, integrating center, afferent pathway, receptor.
b) Stimulus, receptor, efferent pathway, integrating center, afferent pathway, effector.
c) Stimulus, receptor, afferent pathway, integrating center, efferent pathway, effector.
d) Stimulus, effector, afferent pathway, integrating center, efferent pathway, receptor.

When a normally innervated skeletal muscle is stretched the initial response is muscle contraction; this is called

a) Stretch reflex
b) Planter reflex

SUGGESTED TEXTBOOKS

1. Ganong review 25th edition chapter 9 from page 206 to 212
2. Ghyton and Hall 13th edidition from page 696 to 701